Introduction

In recent years, economic competition has driven rapid changes in the hog industry: production has shifted regionally and to larger operations that increasingly specialize in a single phase of hog production and are organized under production contracts. The changing farm structure is altering manure practices, as larger operations seek to manage nutrients on a limited cropland base. At the same time, recent changes to the Clean Water Act, State regulations, and local conflicts over odor are influencing manure management decisions.

Changes in the regulatory climate have been driven by increased environmental risk to air and water associated with the geographic concentration of manure on larger livestock operations. Pollutants such as nutrients, pathogens, ammonia, hydrogen sulfide, methane, and odor can originate from production houses where animals are kept, from manure storage structures such as tanks and lagoons, or from land where manure is applied. The concentration of animals and manure into smaller geographic areas increases the challenge of managing manure, the risk of environmental contamination, and the nuisance potential of farms.

This study uses data from two recent surveys of hog farmers to examine how hog manure management practices vary with the scale of production and how practices changed from 1998 to 2004. The findings provide information about the effects of recent policies and structural changes on manure management technologies and practices, the use of nutrient management plans, and manure application rates.

A Primer on U.S. Hog Production

The production of hogs to be slaughtered for pork involves four phases: (1) breeding and gestation (breeding females and their maintenance during gestation), (2) farrowing (birth of baby pigs until weaning), (3) nursery (care of pigs immediately after weaning until about 30-80 pounds), and (4) finishing (feeding hogs from 30-80 pounds to a slaughter weight of 225-300 pounds). Hog producers are commonly classified according to the number of production phases conducted on the operation: (1) farrow-to-finish (all four phases), (2) farrow-to-feeder pig (phases 1, 2, and 3), (3) feeder pig-to-finish (phase 4), (4) wean-to-feeder pig (phase 3), or (5) farrow-to-wean (phases 1 and 2).

The majority of U.S. hog production has historically occurred on farrow-to-finish operations located in areas with an abundant supply of corn. Hog farmers typically fed corn produced on the farm as an inexpensive source of hog feed and applied manure as fertilizer on farm fields. Advancements since the 1970s in breeding and genetics, as well as in animal housing and feeding, have increasingly moved hog production into large factorylike units staffed with specialized labor. Meanwhile, farms became more specialized in hog production, and hog farms increasingly specialized in only one or two of the production phases. By 2004, 77 percent of market hogs were produced on feeder pig-to-finish operations, while only 18 percent were produced on farrow-to-finish operations (Key and McBride, 2007).

The introduction of contract production arrangements also played a significant role in the evolution of U.S. hog production. In contract production, a pig owner (the contractor) engages a producer (the grower) to take custody of the pigs and care for them in the producer's facilities; compensation depends on a predetermined formula. Contractors typically furnish inputs to growers, provide technical assistance, and assemble the hogs to pass on for final processing or marketing. Contractors often market hogs through marketing contracts or other arrangements with packers or processors, who can also contract directly with growers.

Data

This study uses information from surveys of U.S. hog producers conducted in 1998 and 2004 as part of USDA's annual Agricultural Resource Management Survey (ARMS). The detailed surveys cover a cross-section of U.S. hog operations and collect information on production costs, business arrangements, production facilities and practices, and farm operator and financial characteristics. The surveys also provide information about manure storage and handling, fertilizer use, manure application techniques, payments received under the Environmental Quality Incentives Program (EQIP), use of comprehensive nutrient management plans (CNMP), and manure application rates. The data allow us to document the current state of manure management and provide information about producers' emerging responses to existing and anticipated manure-related regulations.

The sample of hog farms was chosen from a list of operations maintained by USDA's National Agricultural Statistics Service (NASS). The target population of each survey was farms having 25 or more hogs at any time during the year. Farms with fewer than 25 hogs were removed to exclude operations that raise hogs primarily for onfarm consumption and other noncommercial activities, such as youth projects. Each surveyed operation represents a number of similar farms in the population as indicated by the surveyed respondent's expansion factor, or survey weight. The sampling resulted in 1,633 responses from 22 States in 1998, and 1,198 responses from 19 States in 2004 (table 1). The expanded samples in each survey represent more than 90 percent of the hog and pig inventory on U.S. farms in each survey year.

Estimates from the two surveys are comparable because of the consistent way in which the surveys were conducted and processed. Each survey had broad national coverage, represented the same target population, involved a complex sampling scheme designed to represent the target population, was conducted the same way (hand-enumerated) by the same organization, and collected much the same information in a similar format. More information about the ARMS and the hog surveys, including copies of the questionnaires, can be found at http://www.ers.usda.gov/Briefing/ARMS/.

Data from the surveys are analyzed by farm size according to the number of animal units (1,000 pounds of live animal weight) produced. Because larger hogs produce more manure, animal units provide a consistent measure for comparing farms that produce hogs at different stages of the production cycle. For example, farrow-to-finish and hog finishing operations produce much larger hogs, and thus more manure per animal than do farrow-to-feeder pig and specialized nursery operations.

The environmental implications of hog production depend primarily on the manure management decisions of operations with at least 50 animal units since these operations accounted for 96-98 percent of hog output over 1998-2004. For this reason, and to simplify the tabular presentations, statistics for operations with fewer than 50 animal units are not reported in most tables and figures.